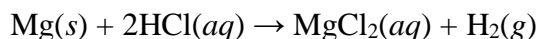


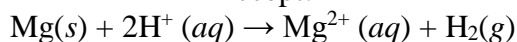
## ANSWERS: Reactivity of metals with acids

1) Magnesium reacts with hydrochloric acid vigorously to form a salt and hydrogen gas. The magnesium reacts and disappears into solution; the solution warms up and there is fizzing due to production of hydrogen gas. Magnesium is high up on the activity series (above H), so will easily react.

Copper is low on the activity series and there is no visible reaction in the acid because it is below hydrogen on the activity series so cannot react to produce a salt and hydrogen gas.



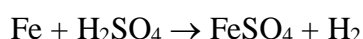
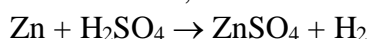
Accept:



2) The zinc reacts and disappears into the solution. Bubbles of gas are observed.

Zinc and iron both react with dilute sulfuric acid relatively slowly. Eventually both metals disappear and some bubbles of gas are formed as hydrogen gas forms in both reactions. Both metals react to form sulfate compounds.

However zinc is higher on the activity series than iron, so the zinc will react somewhat faster than the iron.



Acid is a good electrolyte because it dissociates / forms ions easily ( $\text{H}^+$  and  $\text{SO}_4^{2-}$ ). Ions are charged particles which can conduct a current through a solution.

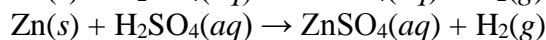
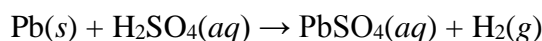
When a battery is being used / discharged, the concentration of the acid decreases. This causes the battery to go flat, as the ions have been removed. The battery then needs recharging to reverse the reactions, and reform acid again. This then increases its concentration.

3) Observations:

Lead – small bubbles of gas appear on the surface of the metal. (It is unlikely that any heat will be detectable or that any of the metal will be able to be seen to disappear, unless over a long period.)

Zinc – bubbles of gas are released. Metal disappears (may detect heat being released).

Equations:

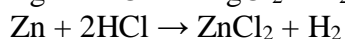
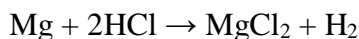


4) Magnesium will react quickly with the hydrochloric acid, producing lots of bubbles of gas. The magnesium will disappear / lose mass quickly. Heat may be observed.

(Metal disappears is acceptable, if in the correct context).

Zinc will react very slowly with the hydrochloric acid producing small numbers of tiny bubbles of gas that will sit on the metal. The zinc will very slowly lose mass over a long period of time. Heat may be observed. (Metal disappears is OK, however, check the context).

Copper will not react with the hydrochloric acid. Magnesium is quite high on the activity series of metals, so reacts quite quickly with hydrochloric acid. Zinc is lower on the series and is less reactive so will only react slowly with hydrochloric acid. Copper is below hydrogen on the activity series so does not react with dilute hydrochloric acid. So we would see a more vigorous reaction with magnesium than zinc and no reaction with copper. Magnesium and zinc do both react with the acid and form similar products. The gas they form is hydrogen gas and they each form metal chloride salts.



(A correct equation gives evidence for products.)